NOAA

National Environmental Satellite, Data, and Information Service (NESDIS)

Comprehensive Large Array-data Stewardship System (CLASS)

Master Project Management Plan

Version 1.0

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Contents

1 PROJECT DEFINITION....1

1.1 OVERVIEW....1
1.2 SCOPE....2
1.2.1 Process....2
1.2.2 Location/Organization....3
1.2.3 Data....3
1.2.4 Application....3
1.2.5 Technology....3
1.3 DELIVERABLES....4
1.4 ASSUMPTIONS AND CONSTRAINTS....4
1.5 SUCCESS AND COMPLETION CRITERIA....5
1.5.1 Acceptance Criteria....5
1.5.2 Critical Success Factors....5
1.6 REFERENCE MATERIALS....5

2 MANAGEMENT STRUCTURE....7

2.1 PROJECT LIFECYCLE....7
2.2 PROJECT ORGANIZATION....8
2.2.1 Project Roles and Responsibilities....9
2.2.2 External Interfaces....10
2.3 COMMUNICATION....10
2.4 RISK MANAGEMENT....10
2.4.1 Risk Management Roles and Responsibilities....11
2.4.2 Tools....11
2.4.3 Procedures....12

3 PLANNING AND CONTROL....16

3.1 ESTIMATION....16
3.2 RESOURCE IDENTIFICATION....16
3.2.1 Staff....16
3.2.2 Time....16
3.2.3 Materials....16
3.3 RESOURCE ALLOCATION....17
3.3.1 Work Breakdown Structure....17
3.3.2 Schedule....18
3.4 TRACKING AND CONTROL....18
3.4.1 Tracking and Control Roles and Responsibilities....18
3.4.2 Earned Value Process....19
3.4.3 Earned Value Method Standards....20
3.4.4 Quality Tracking and Control....21

3.4.5 Functionality Tracking and Control *21*

4 TECHNICAL PROCESS **22**

4.1 ENGINEERING 22
4.1.1 Environment *22*
4.1.2 Methods, Tools and Techniques *22*
4.2 TECHNOLOGY 23
4.2.1 Environment *24*
4.2.2 Methods, Tools, and Techniques *24*

5 SUPPORTING PLANS **26**

5.1 CONFIGURATION MANAGEMENT 26
5.2 QUALITY MANAGEMENT 26
5.3 TESTING 26
5.4 SOFTWARE DEVELOPMENT 26
5.5 OPERATIONS SUPPORT 26
5.6 TEAM ACTIVITY PLANS 26

6 DEFINITIONS AND ACRONYMS **27**

7 APPENDIX – SAMPLE RISK SPREADSHEET **29**

List of Tables

Table 1 - CLASS Major Deliverables 4
Table 2 - CLASS Project Roles and Responsibilities 9
Table 3 - Risk Management Roles and Responsibilities 11
Table 4 - Risk Spreadsheet Information 11
Table 5 - Risk Checklist 13
Table 6 - CLASS Work Breakdown Structure 17
Table 7 - Tracking and Control Responsibilities 19
Table 8 - Standard EV Methods 20

List of Figures

Figure 1 - CLASS Project Organization 8
Figure 2 - Risk Management Process 12
Figure 3 - Earned Value Measurement Process 20

1 Project Definition

This document describes the overall management approach for work to be performed for the National Environmental Satellite, Data, and Information Service (NESDIS), on the Comprehensive Large Array-data Stewardship System (CLASS) project. CLASS is an evolutionary development effort that involves several different government and contractor groups in various geographic locations. This Master Project Management Plan (MPMP) defines the common principles and guidelines to be followed by each participating group. Each group will supplement this overall plan with a detailed project plan with specific information related to management of its component(s) of the system. The MPMP will be reviewed at the start of each NOAA fiscal year, and updated as necessary.

Section 1 describes the overall scope and objectives for the CLASS project. It includes the following topics:

- Overview – describes the CLASS project objectives and background
- Scope – defines the work included in the CLASS implementation
- Deliverables – identifies major work products that will be delivered, and an overall timeline for their delivery
- Assumptions and Constraints – identifies the assumptions and constraints that underlie this plan. Changes to the assumptions or constraints will affect the scope, cost, and/or schedule for this project.
- Success and Completion Criteria – identifies the acceptance criteria for the project and the critical success factors
- Reference Material – refers the reader to additional material for more information on the CLASS project

1.1 Overview

The CLASS project is being conducted in support of the NESDIS mission to acquire, archive, and disseminate environmental data. NESDIS has been acquiring this data for more than 30 years, from a variety of *in situ* and remote sensing observing systems from throughout the National Oceanic and Atmospheric Administration (NOAA) and from a number of its partners. NESDIS foresees significant growth in both the data volume and the user population for this data, and has therefore initiated this effort to evolve current technologies to meet future needs.

The long-term goal for CLASS is the stewardship of all environmental data archived at the NOAA National Data Centers (NNDC). The initial objective for CLASS is to support specifically the following campaigns:

- NOAA and Department of Defense (DoD) Polar-orbiting Operational Environmental Satellites (POES)
- NOAA Geostationary-orbiting Operational Environmental Satellites (GOES)

- National Aeronautics and Space Administration (NASA) Earth Observing System (EOS) Moderate-resolution Imaging Spectrometer (MODIS)
- National Polar-orbiting Operational Environmental Satellite System (NPOESS)
- The NPOESS Preparatory Program (NPP)
- EUMETSAT Meteorological Operational Satellite (Metop) Program
- NOAA NEXt generation weather RADAR (NEXRAD) Program

The development of CLASS is expected to be a long-term, evolutionary process, as current and new campaigns are incorporated into the CLASS architecture. This master project plan defines project characteristics that are expected to be applicable over the life of the project. However, as conditions change over time, this plan will be updated as necessary to provide current and relevant project management guidance.

1.2 Scope

This section defines the CLASS scope in terms of both business scope (processes, location, and organization) and technical scope (data, applications, technology).

1.2.1 Process

The goal of CLASS is to provide a single portal for access to NOAA environmental data, some of which is stored in CLASS itself, and some of it available from other archives. The major processes required to meet this goal that are in scope for CLASS are:

- Ingest of environmental data from CLASS data providers
- Extraction and recording of metadata describing the data stored in CLASS
- Archiving data
- Browse and search capability to assist users in finding data
- Distribution of CLASS data in response to user request
- Identification and location of environmental data that is not stored within CLASS, and connection with the owning system
- Charging for data, as appropriate (see out of scope note below)
- Operational support processes: 24x7 availability, disaster recovery, help desk/user support

While the capability of charging for data is a requirement for CLASS, the development of an e-Commerce system to support financial transactions is out of scope. CLASS will interface with another system for financial transaction; definition and implementation of the CLASS side of that interface is in scope for this project.

1.2.2 Location/Organization

CLASS is being developed and operated under the direction of the NESDIS Chief Information Officer (CIO).

Development of the CLASS system will be performed by NOAA and contractor personnel associated with the Office of Satellite Data Processing and Distribution (OSDPD) in Suitland, MD, the National Climatic Data Center (NCDC) in Asheville, NC, and the National Geophysical Data Center (NGDC) in Boulder, CO.

The operational system will be located at the NOAA facility in Suitland, MD, and the NCDC facility in Asheville, NC.

The project management will be conducted by the CLASS Project Management Team (CPMT), with representatives from each government and contractor team participating in CLASS development and operations. Section 2.2 describes the organizational structure for the CLASS project.

1.2.3 Data

Data stored in CLASS includes the following categories:

- Environmental data ingested and archived by CLASS. Currently this includes data for each of the campaigns listed in Section 1.1, and certain product and in situ data
- Descriptive data received with the environmental data that is used to support browsing and searching the CLASS archive
- Descriptive data that is maintained by CLASS to support searching for data that is maintained in other (non-CLASS) repositories
- Operational data required to support the general operation of the system that is not related to environmental data (e.g., user information, system parameters)

1.2.4 Application

While the full CLASS architecture has not yet been completed, one goal for CLASS is to reuse existing systems where possible. Existing systems that have been identified as sources for CLASS functionality include:

- The Satellite Active Archive (SAA) system, which will provide the basis for the CLASS Archive and Distribution function
- The Satellite Archive Browse and Retrieval (SABR) system
- The NOAA Virtual Data System (NVDS)

1.2.5 Technology

The following technology components are in scope of the CLASS project:

- Application servers

- Data storage and retrieval hardware and system software
- Database management system
- Network connectivity between each of the two (or more as necessary) operational CLASS sites and the NOAA backbone
- Telephone call director for help desk support

Network connectivity between the data providers and the NOAA backbone is out of scope for CLASS. It is assumed that data providers have access to the NOAA backbone, or can stage the data in a location accessible to CLASS via the backbone or via the Internet.

Development, upgrade, or maintenance of the NOAA backbone is out of scope for the CLASS project.

The CLASS customer interface is conducted over the Internet using standard browser technology. No client software or hardware for interfacing with the customer is in scope.

1.3 Deliverables

The following table identifies the major deliverables for CLASS, and the estimated delivery dates. These are key high-level support requirements; more detailed interim milestones are defined in the detailed implementation project plans.

Table 1 - CLASS Major Deliverables

Deliverable	Date
CLASS Release 1.0	December 2002
GOES Initial Operating Capability – distribute GOES data	December 2002
GOES Archive and Distribution	June 2003
Creation of Geotiff Images	June 2003
Geospatial Databases	December 2003
DMSP Archive and Distribute (SABR) integration	December 2003
EOS/MODIS Archive and Distribution	December 2003
NPP Archive and Distribution (end-to-end test)	June 2004
Metop Archive and Distribution (end-to-end test)	October 2004

1.4 Assumptions and Constraints

The following assumptions and constraints underlie the project plan for CLASS. Changes to these factors could affect the cost, schedule, or scope of the work included in this plan.

- The communication link between Suitland and Asheville is upgraded and meets the needs for data transfer between the sites.
- The E-Commerce system to be used for managing CLASS financial transactions will be developed and available for use by December 2003, in order to conduct interface testing with CLASS prior to the NPP end-to-end test. The interface between CLASS

and the E-Commerce system will be defined by December 2002 so that the CLASS team can begin work on the CLASS interface code in time to meet the December 2003 milestone.

1.5 Success and Completion Criteria

1.5.1 Acceptance Criteria

A system integration and test team, independent of the development teams, will conduct testing of all components of CLASS as they are developed and turned over to Configuration Management (CM). This integration and test is a multi-stage process, based on the CLASS system test plan. The stages in the acceptance process are:

- Integration – CMO rebuilds the system in Integration Environment (Suitland) and verifies that the system builds correctly
- Beta test – CMO builds the system in the Beta Test Environment (Suitland), and the system test team conducts testing according to the CLASS system test plan
- Deployment test – CMO builds the system in the Deployment Test Environment (Asheville), and verifies that the system was correctly built. NCDC CLASS operations personnel perform basic system checkout to gain familiarity with the new functionality of the system

Acceptance test criteria are based on the system test plans developed by the system test team.

Formal acceptance of the system and approval to promote to operations is the responsibility of the government CLASS Technical Lead, Alex Kidd.

1.5.2 Critical Success Factors

- Each team has a detailed project plan that includes dependencies between teams, and provides sufficient intermediate milestones for tracking.
- Project progress is tracked to provide the CLASS Project Management Team (CPMT) with accurate and current status and forecasts.
- Risks are identified and managed by the CPMT on a regular basis.
- Standard development processes are defined and followed by all CLASS development teams.
- Lessons-Learned sessions are conducted to support process improvement.

1.6 Reference Materials

The following documents supplement this PMP for CLASS and provide more detail on specific topics related to CLASS project management:

- CLASS Quality Management Plan (August 2002)

- CLASS Configuration Management Plan (July 2002)
- CLASS Software Development Guide (July 2002)
- Individual team Activity Plans

All of the above documentation is available in the NOAAForge collaborative space under the CLASS projects: class1.nesdis-hq.noaa.gov

Additional detailed technical documentation for CLASS is available online in the CLASS online library: library.saa.noaa.gov

2 Management Structure

This section addresses the overall management approach for the CLASS effort, including

- Project lifecycle
- Project organization
- Project communications
- Risk management

2.1 Project Lifecycle

CLASS is based on the existing SAA system for data archive and distribution, now designated CLASS Release 0 (R0). Additional functionality will be added to CLASS to support new campaigns and expanded data analysis and retrieval capabilities. The new architecture and requirements are being defined while the existing operational system is being supported and upgraded. Hence, no single "lifecycle" applies to the full scope of the effort. The methodology for supporting these two concurrent activities will be an iterative release-based approach, in order to support new campaign requirements as they are identified, while minimizing distribution to the operational system. CLASS will use the guidance of the Software Engineering Institute (SEI) Software Capability Maturity Model (CMM) to drive key processes in the development effort.

The CLASS approach will encompass the following major development phases:

Requirements Definition/Analysis

CLASS system requirements come from the following sources:

- Current SAA (CLASS Release 1.0) capabilities that must be maintained
- New campaign requirements
- CLASS vision as a single portal for all NOAA environmental data.

The project will use the requirements management tool DOORS to document and track the system requirements, whatever their source. These system level requirements are then allocated to a CLASS component (e.g., archive and distribution) and developed into more detailed implementation requirements. The CLASS system and allocated requirements will be reviewed and approved by the CPMT as the initial baseline. New requirements, for example from new campaigns, will be managed as Configuration Change Requests (CCRs), and reviewed and approved by the CLASS Configuration Control Board (CCB) before being scheduled for implementation. The CCR process is described in detail in the CLASS Configuration Management Plan.

Preliminary/Detailed Design

The assigned development group will complete the detailed analysis and design for each new capability at the start of the corresponding release. The design will undergo technical review before it is baselined for implementation. The Software Development Guide provides details of the analysis and design activities and review.

Software Code and Test

The assigned development group will implement the approved design following the CLASS coding standards and review processes. Developers will conduct initial unit and module testing, and an independent system test team will conduct full integration and system test of each release before promotion to operations. Coding standards are defined in the Software Standards for IPD (June 30, 2001). The Software Development Guide provides details of the code and test activities and reviews.

Software version control procedures and processes are defined in the CLASS Configuration Management Plan.

2.2 Project Organization

The CLASS project is a joint effort of various government and contractor organizations, under the direction of the NESDIS CIO. Each participating organization is led by a Technical Area Lead (TAL). The project will be managed by a project team that includes the TALs from each government and contractor organization: the CLASS Project Management Team (CPMT). The chart below shows the governing bodies involved in the management and oversight of the CLASS project.

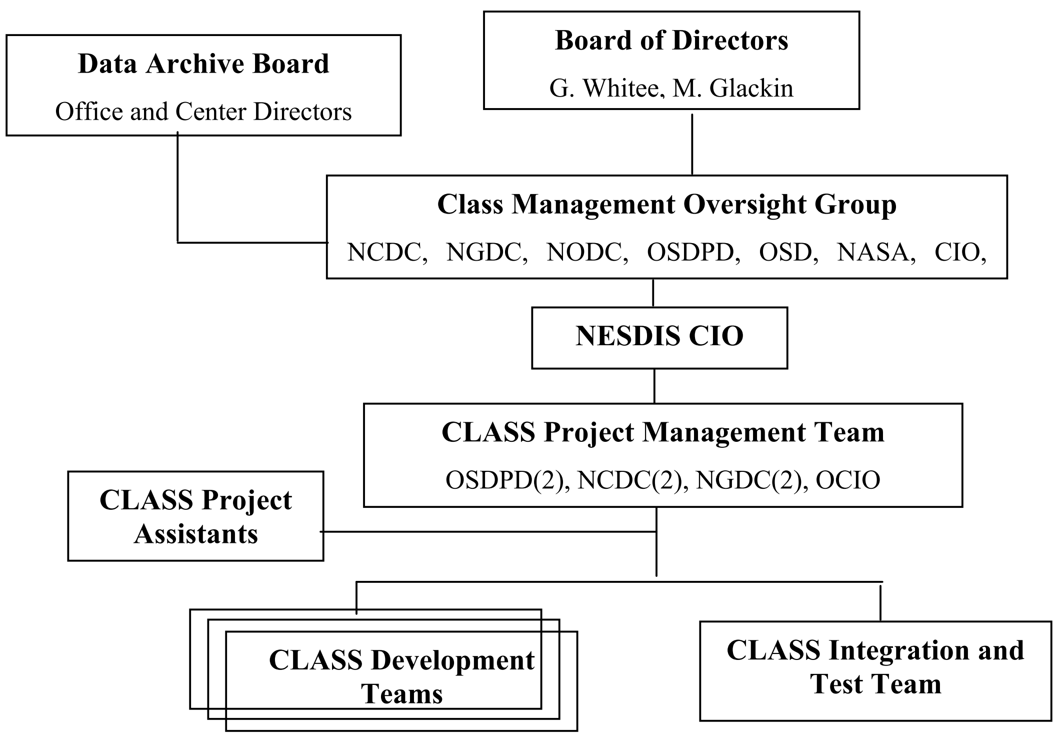

Figure 1 - CLASS Project Organization

2.2.1 Project Roles and Responsibilities

The responsibilities of each of the governing bodies are defined in the following table:

Table 2 - CLASS Project Roles and Responsibilities

Role	Responsibility
NESDIS Management	Provides strategic direction and funding for CLASS
Data Archive Board	Reviews archive and distribution requirements for NOAA and determines role of CLASS in supporting those requirements
CLASS Management Oversight Group	Provides ongoing review and direction for CLASS project
NESDIS CIO	Provides direction and leadership for the CLASS project. Allocates responsibility and funding for components of CLASS to participating organizations. Defines project goals and objectives. Manages progress towards project goals.
CLASS Project Management Team	Supports NESDIS CIO in project planning and tracking activities. Provide leadership for the participating development groups; provides coordination of activities within each participating organization
CLASS Project Assistants	Project Control Office – supports integration of component schedules and plans; collects and processes project status; distributes CLASS project Earned Value reports and assists the CPMT in analysis of the reports Quality Management Office – supports the CPMT in the definition and implementation of software development processes; provides independent verification of compliance with CLASS standards and procedures. Lead Integrator – provides technical oversight of day-to-day development activities to ensure consistency and compatibility of the components of CLASS; leads integration and test of CLASS components
CLASS Development Teams	Develop components of CLASS: conduct analysis, design, code and development testing of new components
CLASS Integration and Test Team	Conduct independent verification of new functionality developed for CLASS

2.2.2 External Interfaces

The CPMT provides the point of contact with other CLASS stakeholders, such as the current campaign operations teams for those campaigns planned for integration with CLASS (e.g., NASA IPO), and the operations teams at the CLASS operational sites.

2.3 Communication

In a large, dispersed team such as the CLASS team, facilitating communication is essential to the project success. The following formal communication within the joint CLASS team is planned to ensure appropriate coordination of the various organization development teams:

- Weekly CPMT teleconferences, with the following standing agenda items
    - Review of status of inter-group dependencies
    - Review of selected tasks (identified by the CPMT based on risk, schedule criticality, visibility, etc.)
    - Identify issues and assign action items for their resolution
- Written project schedules from each development team
- Monthly progress reports to include task status and budget information (see Section 3.4 below)
- Monthly video-teleconference meeting of CPMT, with the following standing agenda items
    - Review risks (see Section 2.4 for details of the Risk Management process)
    - Review status of draft documents and planned approval dates
    - Review action items status
    - Review earned value reports
    - Report from Technology Research Group
    - Quality Management Report
- Periodic meeting of full joint development teams to review status, process, and issues

Additionally, special interest groups will be formed around major functional capabilities (e.g., user interface, data ingest) to facilitate coordination and knowledge-sharing among developers in different organizations who are working on similar or related topics. An online collaborative environment will be used to support communication and teamwork among the project members, and an online library will be maintained for project documentation.

2.4 Risk Management

Managing risk is the identification, evaluation, mitigation, and re-evaluation of events that may have an unfavorable impact on the work.

Risk management is a recurring cycle of activities. Major risks are identified when first planning a project; other risks become apparent later. When planning a project, the responsible project team will analyze risks and develop plans to avoid or mitigate them. The CPMT will review the risks on a regular basis in order to re-evaluate the possibility of risks occurring, to identify new risks, and then to activate plans to prevent their occurrence or to minimize their impact.

2.4.1 Risk Management Roles and Responsibilities

The following table summarizes the roles and responsibilities of CLASS project personnel in risk management.

Table 3 - Risk Management Roles and Responsibilities

Role	Responsibility
TAL	• Lead risk management activities for their area of the project: identification, analysis, and mitigation planning • Present risk assessment to CPMT • Monitor risks and reassess • Report new or changed risks to the CPMT
All team members	Participate in risk identification and assessment and provide input to their TAL
Lead Integrator	Assist project teams in analysis and mitigation planning as needed
CPMT	• Review risks on a regular basis • Support TAL as needed in developing or implementing mitigation plans
Project Control Office (PCO)	Maintain CLASS consolidated risk list and coordinate CPMT risk review
NESDIS CIO	Determine when to escalate risk to other parties

2.4.2 Tools

Each TAL will document the risk assessment and mitigation information in a spreadsheet with the following information:

Table 4 - Risk Spreadsheet Information

Column Heading	Description
Risk ID	Sequential number assigned by PCO

Risk Title	Short title describing event that is considered a risk
ID Date	Date risk was identified
Area of Impact	What area is likely to be affected if the risk occurs: cost, schedule, quality, scope
Probable Impact Date	Date when project will be affected if the risk event occurs
Risk Warning Flag	Early indicator that risk event is likely to occur
Risk Probability (%)	Probability that risk will occur
Potential Risk Cost ($K)	Potential cost to the project if the risk event occurs, converted to $$ (e.g., if impact is schedule slip, what will be the cost to the project of the schedule slip). If cost cannot be quantified, describe potential impact
Probable Risk Cost ($K)	Computed "expected value" of cost: risk probability x potential risk cost
Risk Priority	High, medium, or low priority indicator, based on probable risk cost. This designation will determine the attention and effort expended to avert the risk event.
Mitigation Plan	Sets of actions to reduce either the probability of the risk being realized or the cost of its realization

A sample risk spreadsheet is attached in Appendix A.

2.4.3 Procedures

The figure below, Risk Management Process, illustrates the flow of the risk management process. Each step in the process is discussed briefly below, from the CPMT perspective. Each participating organization is expected to follow a similar internal process for risk management.

Figure 2 - Risk Management Process

Identify

Risks will be identified either by an individual project team or by the CPMT itself. The Risk Checklist table below lists some common risks that should be considered in performing risk identification.

The Risk Checklist contains the types of questions that will help identify the three types of project risks:

- **Known Risks:** those identified as direct consequences of assumptions about the situation or inadequacies in the information provided.
- **Potential/Predictable Risks:** those that are known from experience to be encountered in projects of the type being planned.
- **Unknown Risks:** those that, perhaps suspected, cannot be confirmed with the same degree of confidence as known or predictable risks.

Table 5 - Risk Checklist

Risk Checklist	
Known Risks	• Is there a recognized project sponsor? • Has the Project Plan been formalized and approved? • Are there rigid conditions or constraints? • Are the project manager and team members experienced in this type of project? • Are there unverified assumptions, and are the assumptions valid? • Are the Acceptance Criteria defined and agreed to? • Are the subcontractors and vendors known and reliable? • Were estimates based on actual efforts for similar processes and deliverables? • Is the schedule realistic, and is each milestone in the schedule reasonable? Can delivery dates be adjusted if needed? • Will it be difficult to receive additional project funding, if needed?
Potential/ Predictable Risks	• Are expectations known and acceptable? • Are there external dependencies and responsibilities? • Will key stakeholders be accessible and committed to the project results? • Is the work completely defined? • Will promised information sources be available and of adequate quality? • Will user reviews, delivery acceptance, and management review be timely? • Are requirements adequately specified? • Is the development or test environment adequate? • Will new or unfamiliar development tools be used? • Are the workspace and work environment adequate? • Can the workspace accommodate a larger staff if needed? • Has a similar project attempt failed before?

Potential/ Predictable Risks (cont.)	• Is the design complete? • Will the acceptance process be difficult? • Is the technical infrastructure adequate? • Is a new or unfamiliar technology required? • Are the requirements technically complex or innovative? • Are the functions complex or difficult? • Are the technical performance requirements demanding? • Will technical support be committed to the project? • Does project success depend on a few key individuals? • Does the project plan accommodate a learning curve? • Is the staffing plan practical? • Have the Project Plan and Project Schedule accounted for vacation, sickness, and administrative time?
Unknown Risks	• Will the project priorities change? • Will the business case remain persuasive? • Will funding availability change? • Will project objectives be redefined? • Will key project personnel change?

Analyze

For each risk, the group identifying the risk will

- Quantify the threat posed.
- Determine to what extent it could affect the work.
- Determine the resources that should be applied to control or eliminate it.
- Set an initial priority for that risk.

When an individual project team identifies a risk, that team will complete the initial analysis and define a mitigation plan. The TAL brings the risk assessment spreadsheet to the CPMT.

When the risk is identified by the CPMT, the CPMT performs the analysis and planning, or assigns the CLASS System Engineering Team (SET) or one of the teams to complete it, depending on the scope and nature of the risk identified.

The PCO records the new risk with other identified risks, assigning it a risk identification number.

Plan

The mitigation plan identifies actions that will diminish or remove risk. The cost of the risk happening (potential cost) is weighted by the probability of the risk occurring, and the resulting probable cost compared with the cost of preventive actions. This will help the project to choose among possible risk mitigation strategies. Some risks will not be worth preventing because the cost of prevention is too great compared to the weighted cost of the risk.

The mitigation plan also identifies how progress on each risk mitigation task will be monitored and reported, to ensure that any problems associated with the risk are highlighted early.

The CPMT reviews the mitigation plan for each identified risk, noting any potential impact to other areas of CLASS, or any way that the other groups can help to mitigate the risk.

Implement

The TAL or the CPMT, as appropriate, determines the right time to apply a risk mitigation strategy. While preemptive mitigation is ideal, its cost is frequently prohibitive. Conversely, waiting too long may preclude the ability to mitigate a risk. For example, it is very difficult to institute a scope control procedure when the project is one-third complete and there are major scope issues.

It may be necessary to identify an alternative strategy to be implemented in the event that the first choice (possibly cheapest) strategy doesn't have sufficient effect, or dual strategies may be needed in order to gain the combined effects.

As risk mitigation strategies are initiated, the risk owner will revise the risk probability or potential risk cost to reflect the new situation. For example, implementing a rigorous scope control process will mitigate a 90 percent risk of scope creep. The new risk probability might then be only 20 percent.

Monitor

The PCO will maintain a list of risks that should be monitored by the CPMT. Risks will be reviewed at the monthly CPMT meetings, to see if the risks identified are still valid, if priorities have been altered, or if the plan should be realigned. The responsible TAL will monitor the risk warning flags and react quickly to implement planned direct risk mitigation strategies.

Reassess

Each TAL will continually reassess the risks in that area of the project, identifying new risks, re-evaluating risks based on the success of the mitigation activities, or retiring risks as they are no longer considered threats. The TAL reports on updated risk status at the monthly CPMT meetings.

3 Planning and Control

This section covers the planned approach for estimating, planning, and controlling the work.

3.1 Estimation

Estimates for CLASS are primarily based on similar experience, i.e., actual effort and duration required for the previous SAA releases, and/or reported effort and duration for development of other existing systems that support the relevant campaigns. Where previous experience is not available (e.g., new technologies or programming language), the project will conduct prototypes before final estimation of the full system development effort. The Software Development Guide provides a detailed description of the CLASS estimation process.

3.2 Resource Identification

3.2.1 Staff

As work is allocated to the participating organizations, each affected organization will prepare a work plan indicating required staffing and skill levels. The CPMT will review each work plan as needed, and the NESDIS CIO must approve all plans. Staffing levels will be reviewed at each major milestone to determine if the available staff is adequate to support work planned.

3.2.2 Time

CLASS is expected to be a continually evolving system, as new campaigns and capabilities are integrated into the base system. Major milestones that will drive the activities in the near-term are defined in Section 1.3.

3.2.3 Materials

All materials to be used on the CLASS project will be supplied by NOAA.

A development system will be installed at each major geographic development site, initially to include Suitland, MD, Fairmont, WV, and Boulder, CO. The integration and test system will be resident at the NOAA Suitland facility. The deployment test system will reside at NCDC in Asheville, NC. The operational system will be duplicated at Suitland, MD and Asheville, NC.

3.3 Resource Allocation

3.3.1 Work Breakdown Structure

The following table shows the top levels of the WBS for CLASS. This provides the level of information required for project planning and tracking at the CPMT level. Lower levels are defined in the individual MS Project schedules developed by each participating organization.

Table 6 - CLASS Work Breakdown Structure

WBS #	Name	Description	Active Groups
1	Management		
1.1	Project Management		All
1.2	Quality Management		CSC
1.3	Configuration Management		CSC
1.4	Project Control		CSC
2	System Engineering		
2.1	CLASS System Architecture	Define, document, and maintain CLASS system architecture	All
2.2	CLASS System Requirements and Concept of Operations	Define, document, and maintain system requirements and concept of operations	All
2.3	CLASS Allocated Requirements	Define, document, and maintain allocated requirements	All
2.4	Interfaces	Define interfaces	All
2.5	Usability Assessment		NGDC-T
2.6	Engineering Research Grants		NGDC-T
3	System Infrastructure		
3.1	Upgrade Suitland Infrastructure	Assess and upgrade system hardware and software at Suitland facility	CSC
3.2	Replicate system at NCDC	Replicate operational environment at Asheville, NC facility	CSC, NCDC, TMC
3.3	NGDC Dev system		NGDC-E
3.4	COAST hardware & sys s/w		COAST
3.5	Tool support		CSC, NGDC-E, COAST
4	Implementation	Define requirements, design, and implement CLASS releases	
4.1	Implement CLASS R1 (Dec02)		CSC, TMC
4.2	CLASS R2 (June03)		CSC, TMC, NGDC-T
4.3	CLASS R3 (Dec03)		All
4.4	CLASS R4		CSC, TBD

5	Integration, Test, & Deployment		
5.1	CLASS R1		CSC, NCDC
5.2	CLASS R2		CSC, NCDC
5.3	CLASS R3		CSC, NCDC
5.4	User Training		COAST
6	Documentation		
6.1	CM Plan	Maintain CM documentation	CSC
6.2	QA Plan	Maintain QA documentation	CSC
6.3	Software Development Guide	Maintain SD Guide	CSC
6.4	Test Plan	Write and maintain CLASS Test Plan	CSC
6.5	Operations Support Plan	Write and maintain Op. Support Plan	CSC
7	CLASS Support		
7.1	Unplanned project support	Support each other as needed	All
7.2	System support		All
8	Operations Support	Operational support	
8.1	Asheville Ops		NCDC, TMC
8.3	Suitland Ops		CSC
8.4	Science support		All

3.3.2 Schedule

The high-level milestones for deliverables are provided in Section 1.3. The detailed schedule activities are provided in the individual component MS Project files, and rolled up to the CLASS level in the CLASS master schedule.

3.4 Tracking and Control

CLASS cost and schedule will be managed using an earned value measurement system. This section describes the process and standards for earned value planning and tracking.

3.4.1 Tracking and Control Roles and Responsibilities

The assigned TAL is responsible for the detailed planning and tracking of activities assigned to that group. The CPMT provides oversight at the work package (WP) level, as defined in the WBS, and facilitates collaboration among the TALs to address budget, schedule, or cost problems encountered. The following table summarizes the roles and responsibilities related to project tracking:

Table 7 - Tracking and Control Responsibilities

Role	Planning Responsibility	Tracking/Control Responsibility
CPMT	• Define WBS • Assign work packages to participating organizations	• Analyze regular earned value reports to assess overall project status and problem areas • Determine corrective action when action beyond the owning TAL control is required
TAL	• Prepare detailed plan for each assigned WP, based on CLASS standards	• Prepare task status and actual cost report, based on CLASS Earned Value (EV) review cycle • Analyze earned value report for assigned work packages and define corrective action when needed
PCO	• Support TALs and CPMT in planning work packages • Integrate detailed plans • Setup EVM tool	• Collect status information from TALs and input to Earned Value Measurement (EVM) tool • Use EVM tool to generate reports • Support TALs and CPMT in analysis of the EVM reports
NESDIS CIO	• Review CLASS master schedule	• Escalate issues outside of CPMT when necessary

3.4.2 Earned Value Process

The following figure summarizes the processes associated with planning and tracking CLASS progress, using earned value measurement.

Setup

Reporting

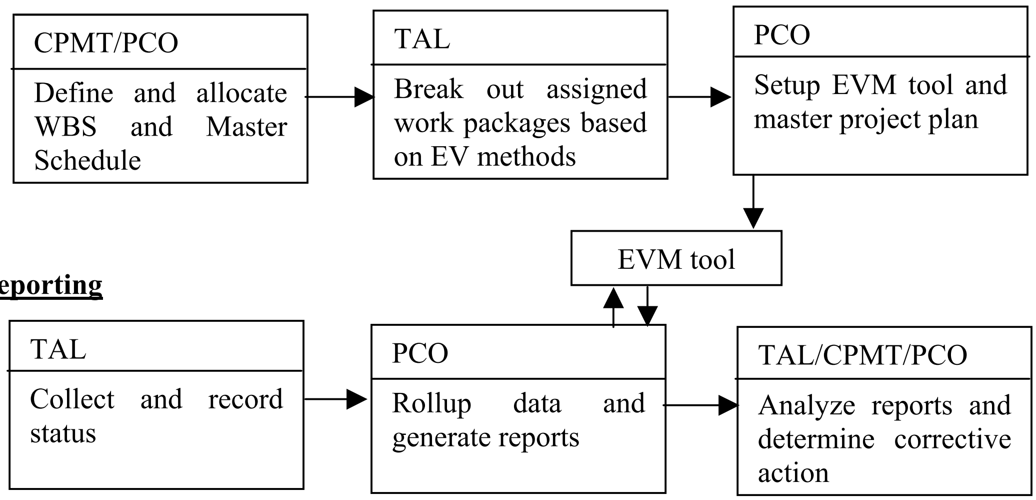

Figure 3 - Earned Value Measurement Process

Based on input from the TALs, the EVM tool will generate project performance reports to include cost, budget, and schedule variances, trends, and estimates to complete. These reports will be generated monthly to provide the CPMT with the necessary performance information to successfully manage the CLASS project.

3.4.3 Earned Value Method Standards

The following table summarizes the standard EV methods to be used for CLASS, and the type of work package or activity that is appropriate for each.

Table 8 - Standard EV Methods

Method	Description	Use on CLASS
Equivalent Units	Assign BCWP based upon accomplishing a portion of the total population of a large number of units	• Large software implementation • Hardware production • Large data volume processing
50-50	Assign half BCWP at start, half at completion - usually in two different accounting periods	• Short engineering analyses • Functional design • Build and Acceptance testing

Method	Description	Use on CLASS
0-100	Assign budgeted cost of work performed (BCWP) upon completion of an activity that occurs within one accounting period	• Outline / agenda • "Events" • Presentations
Interim Milestones	BCWP assigned at objective milestones over 2+ months	• Long-term analyses • Requirements definition • Large Documents
Percent Complete	Used for work with no Interim Milestones	• Long-term studies • Engineering follow-on • Maintenance and Operation
Apportioned Effort	BCWP calculated as a portion of a related discrete effort	• Product assurance • Software librarian • Database manager
Level Of Effort	BCWP earned on passage of time; work cannot be defined, measured, or scheduled	• Project management • Receptionist • Support organizations

3.4.4 Quality Tracking and Control

Quality of the products produced for CLASS will be monitored through peer review, independent testing, and periodic process audits, as defined in the CLASS Quality Management Plan and the CLASS Software Development Guide.

3.4.5 Functionality Tracking and Control

Functionality of the CLASS system will be tracked using the DOORS tool for requirements tracking, and CVS for software version control. The CMO manages all proposed changes to the approved system baseline (requirements, software, hardware, etc.), with the review and approval of the CLASS CCB. For more detail, refer to the CLASS Configuration Management Plan.

4 Technical Process

This section summarizes the top-level technical approach used on this project. Details about the technical processes are provided in the Software Development Guide

4.1 Engineering

This section describes the organizational environment and processes that define the engineering approach for the CLASS project.

4.1.1 Environment

The Software Development Guide and the CLASS Configuration Management Plan provide system and software engineering processes for use throughout the CLASS project for all phases of the development life cycle. Specifically, the Software Development Guide includes the CLASS processes for the following activities:

- Release planning
- Estimation
- Peer review
- Design, code, and documentation standards
- Testing

The Configuration Management Plan describes the process for managing changes to requirements or other system baseline elements, and the promotion process for CLASS software.

A CLASS Systems Engineering Team (SET), following the processes defined in the Software Development Guide, will coordinate the engineering functions. This will be a cross-organizational team consisting of technical representatives from each participating organization, government and contractor. This team will help assure that all CLASS system-level requirements are defined and allocated to the appropriate organization for analysis and implementation.

4.1.2 Methods, Tools and Techniques

The activities of the SET will include:

- System definition and design:
  - Validate a comprehensive system concept
  - Validate system-level requirements derived from approved system concept
  - Validate the system architecture and allocation of system requirements to subsystems

  - Document and maintain system requirements and their allocation throughout the system life cycle
  - Develop system performance and system effectiveness metrics
  - Define system acceptance criteria
- Implementation:
  - Ensure compliance of detailed design with system-level requirements
  - Conduct requirement-change impact assessment
  - Provide workaround and fallback solutions to critical design issues
  - Measure and evaluate system effectiveness
- Integration and test:
  - Verify compliance of test definition and test results with system-level requirements
  - Resolve technical issues
  - Support transition to operations

After the requirements have been allocated to a specific development team, the development team activities will include:

- Software and database design
- Software implementation
- Testing
- Configuration Management
- Documentation
- Problem reporting and tracking

CLASS will maintain central CM and system test teams to manage the integration and delivery of the system releases.

CLASS will use the requirements management tool DOORS to document requirements and to maintain traceability from requirements to design elements and to test cases.

CLASS will use NOAAForge for collaboration among the various development teams.

4.2 Technology

This section describes the physical development environment and the tools and methods used to support development.

4.2.1 Environment

CLASS software will be developed and maintained at several development sites linked to a Central Development Facility (CDF), located in Suitland, MD. The development sites will be in:

- Suitland, MD
- Asheville, NC
- Fairmont, WV
- Boulder, CO

The CLASS configuration management team will setup and maintain the software repository server at the CDF. It is the responsibility of each site to setup and maintain their local development environment. Developers at each site will check out software from the central repository, copy it to their local systems, develop and test software locally, and “Commit” finished products to the CDF.

The CLASS configuration management team is responsible for promoting software to the integration and test environments and to operations. Each release will be integrated and independently tested at the CDF, and distributed from there to the operational sites.

The operational system will be located at the NOAA facility in Suitland, MD, and the NCDC facility in Asheville, NC. These two sites will archive and have access to the same data files so that failover can be effected quickly and either site can fill any order and support all operations. Test teams at each operational facility will conduct acceptance testing of each software release.

4.2.2 Methods, Tools, and Techniques

A variety of tools are currently in use to support technical activities. New tools may be added, upon SET approval, as CLASS evolves. The current tool set includes the following:

- The Telelogic package Tau-UML (formerly Object Team) supports object-oriented design with the Unified Modeling Language (UML). It generates various diagrams that are useful for analysis and design (e.g., Use Case, Activity, State, Sequence, Class Association diagrams), verifies design consistency, and generates reports.
- The primary programming languages used are C++, Java, JavaScript, and Perl.
- Off-the-shelf components are used in the Java/XML-based user interface:
  - Apache - HTTP server
  - Cocoon - publishing framework
  - Turbine - database connection pooling
  - Tomcat - servlet engine
  - Log4j - message logging
  - Informix Java Database Connectivity (JDBC) Driver

- Perl scripts are used to automate testing
- The freely available Concurrent Versions System (CVS) provides software version control in the distributed development environment.
- A suite of custom-built Perl programs is used to manage and log software promotions
- Off-the-shelf tools are use to generate on-line software reference documentation in HTML format (e.g., Javadoc, Doxygen)
- The Remedy Change Management system is used to create and track problem reports
- The Informix database supports all phases of development, configuration management, and operations
- ERWin is used for database design.
- NOAAForge will be used for collaboration among the various technical teams.

5 Supporting Plans

This section references the detailed supporting plans.

5.1 Configuration Management

CLASS Configuration Management Plan, October 1, 2002

5.2 Quality Management

CLASS Quality Management Plan, October 4, 2002

5.3 Testing

Regression and acceptance test plans, TBW

5.4 Software Development

Software Standards for Information Processing Division (IPD), June 30, 2001

CLASS Software Development Guide, October 1, 2002

5.5 Operations Support

CLASS Operations Manual, TBW

CLASS System Support Guide, TBW

5.6 Team Activity Plans

At the start of new sub-projects of CLASS, the team prepares an activity plan, based on this master plan, and tailored to the specific activities included in the sub-project. These plans are posted in the NOAAForge collaborative space for the CLASS Project Management Project.

6 Definitions and Acronyms

BCWP	Budgeted Cost of Work Performed
CCB	Configuration Control Board
CDF	Central Development Facility
CIO	Chief Information Officer
CLASS	Comprehensive Large Array-data Stewardship System
CM	Configuration Management
CMM	Capability Maturity Model
ComMIT	Comprehensive Management Information Tool
CMO	Configuration Management Office
CPMT	CLASS Project Management Team
CSC	Computer Sciences Corporation
CVS	Concurrent Versions System
DoD	Department of Defense
EOS	Earth Observing System
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EV	Earned Value
EVM	Earned Value Measurement
GAA	GOES Active Archive
IOC	Initial Operating Capability
IPD	Information Processing Division
IPO	Integrated Program Office
Metop	European Meteorological Operational Satellite Program
MODIS	Moderate-Resolution Imaging Spectrometer
NASA	National Aeronautics and Space Administration
NCAAS	NOAA Coast watch Active Access System
NCDC	National Climatic Data Center
NESDIS	National Environmental Satellite, Data, and Information Service
NEXRAD	NOAA NEXt generation weather RADAR Program
NGDC	National Geophysical Data Center
NNDC	NOAA National Data Centers

NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanic Data Center
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPP	NPOESS Preparatory Program
OSD	Office of System Development
OSDPD	Office of Satellite Data Processing and Distribution
PCO	Project Control Office
POES	NOAA and DoD Polar-orbiting Operational Environmental Satellites
QM	Quality Management
SAA	Satellite Active Archive
SABR	Satellite Archive Browse and Retrieval
SEI	Software Engineering Institute
SET	System Engineering Team
SPIDR	Space Physics Interactive Data Resource
TAL	Technical Area Lead
TBW	To be written
TMC	TMC Technologies
WBS	Work Breakdown Structure
WP	Work package

7 Appendix – Sample Risk Spreadsheet

The following is a sample risk spreadsheet. See Section 2.4 for a discussion of the Risk Management process.

CLASS Risk Inventory and Assessment Worksheet										
Risk ID	**Risk Title**	**ID Date**	**Area of Impact**	**Probable Impact Date**	**Risk Warning Flag**	**Risk Probability (%)**	**Potential Risk Cost ($K)**	**Probable Risk Cost ($K)**	**Risk Priority**	**Mitigation Plan**
1	T3 line not available	05/14/02	schedule	12/01/02	not in place 09/02	50%			M	
2	E-Commerce component not ready	05/14/02	scope			50%			M	
3	H/W upgrade delayed	5/14/2002	scope			50%			M	